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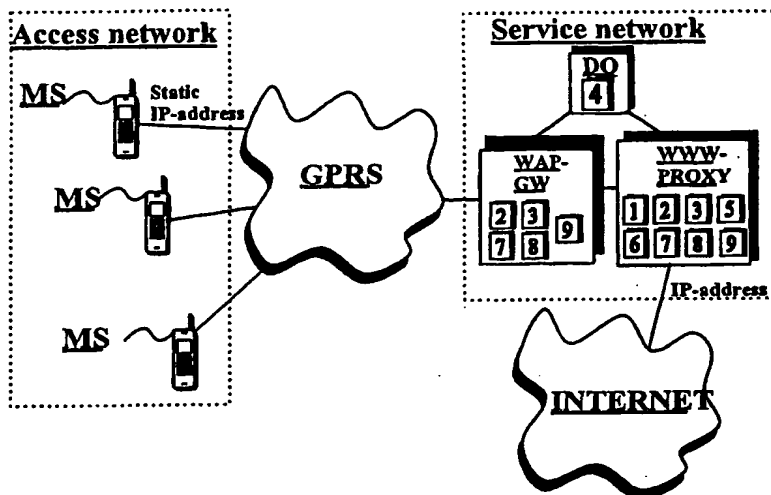
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(54) Title: BILLING ARRANGEMENT FOR A SERVICE IN A TELECOMMUNICATION SYSTEM



(57) Abstract: The invention relates to a method and system for arranging billing in a telecommunication system. The system comprises a packet-switched telecommunication network, in which there are handled operations connected with the transmission of a wireless data transfer, a terminal device MS, by which the subscriber is connected to the packet-switched telecommunication network, a service network, which comprises a set of transmission components, a telecommunication network, and a transmission component which is connected to the aforementioned packet-switched telecommunication network as well as to the aforementioned telecommunication network for connecting them. In the invention, the subscriber number, the IMSI or MSISDN number, is attached to the IP address of the subscriber, and based on this piece of individualizing information, billing data is collected by subscriber and transaction basis from the components of the service network.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Billing arrangement for a service in a telecommunication system

The present invention relates to telecommunication technique.

5 In particular, the invention relates to a new type of method and system by means of which subscribers are allocated an address from the internal address space of the access network, and the transmission components of the service network are allocated an address from the address space of the telecommunication network. In addition, in the invention there is established a connection between the subscriber and the telecommunication network by way of the transmission component, and billing data is collected from the transmission components of the system.

BACKGROUND OF THE INVENTION

Mobile communication networks such as GSM networks (GSM, Global System for Mobile communications) are gaining popularity in a big part of the world. The advantage of mobile communication networks over traditional fixed telephone networks is the air interface enabling a wide-ranging mobility. Most of the world's GSM operators have offered the data transfer service included in the GSM specification as early as since the introduction of the GSM, i.e. the year 1994. The circuit-switched data transfer service with the transfer rate of 9.6 Kb/s currently used provides the possibility to use several different services, such as e-mail and wireless connections to the information networks of companies and to the Internet, fax services, short message services, etc.

The present GSM data transfer services are based on circuit-switched technology, and the data-communication link uses on the air interface one time slot (TDMA, Time Division Multiple Access). This en-

ables a data transfer of 9.6 Kb/s at the maximum both for data transfer and fax services as well as for e-mail and WAP services. Currently it is, however, possible, with special arrangements, to achieve a transfer rate of 14,400 Kb/s, but the transfer rate is still too low.

At present, with the enhancement of data transfer, and especially the wireless data transfer, one has introduced the GPRS networks (GPRS, General Packet Radio Service). The GPRS technology includes the updates of the packet-data network substantial with regard to the operation and the necessary updates of the mobile communication network. The packet-switched data-transfer technique includes features of the present short message service (SMS, Short Message Service) and USSD technique (USSD, Unstructured Supplementary Service Data), and is developing towards a packet-switched data-transfer technique. Correspondingly, the circuit-switched data-transfer technique is developing towards an HSCSD technique (HSCSD, High Speed Circuit Switched Data).

The packet-switched GPRS technology is a new service of the GSM network that enables a packet-switched data-communication link to the users. One main objective of the GPRS service is to provide the users of mobile stations with connections to information networks implemented using protocols, such as e.g. the TCP/IP and X.25. The GPRS technology enables a rapid and efficient data transfer, e.g. from the Internet to mobile stations and vice versa. The GPRS technology enables one to make the present telecommunication networks faster, due to which the subscribers may be offered new wireless Web and IP services.

The GPRS technology offers high transfer rates in short bursts, in theory even over 100 Kb/s. In the GPRS technology, the switching time is very fast, approx. 1-2 seconds. The switching is done only

once during the connection, although the connection would not be in active use. The transfer capacity provided by the GPRS technology can be used very flexibly and economically, the alternatives ranging from 100
5 bit/s or below to 100 Kb/s or over. Furthermore, the time slots can be allocated randomly between different subscribers.

The provision of new GPRS services is expected to begin during the year 2000. From the GPRS
10 service benefit e.g. applications of the following type: telemetry, remote control, railway control systems, toll systems, information systems of traffic information, order systems of taxis, real-time e-mail, interactive use of information, and WWW-based use of
15 the Internet and intranet.

In conjunction with the GPRS technology one speaks about a wireless Internet. The wireless Internet is different than the Internet of a fixed network, in which a typical terminal device is a normal PC computer. When speaking about the wireless Internet the
20 transfer rate is lower than that of a fixed network. This is due to the small number of radio frequencies and restrictions set by the terminal device technology. Because of this, there is a need for the big,
25 short-termed transfer capacity provided by the GPRS technology.

The small size of terminal devices, i.e. in this case mobile stations and different PDA devices (PDA, Personal Digital Assistants), inevitably leads
30 to compromises, and the application of the latest, so-called state-of-art PC software e.g. in PDA devices is challenging. Furthermore, one restrictive factor is the expensive construction of world-wide mobile communication networks, and this will most probably lead to
35 the fact that a bit in a fixed network will be markedly more inexpensive than a corresponding information unit in a mobile communication network. There is, nev-

ertheless, an evident demand for a place-independent, so-called specified retrieval of information among mobile subscribers.

On the wireless Internet, the creation of a user-specific address is substantial, and particularly the fact that the subscribers can be identified by some mechanism. On the wireless Internet, the address space of IP version 4 allocated for subscribers is too small, in which case it is impossible for the operator to allocate each subscriber an address of their own. This is one considerable problem with the wireless Internet.

Generally, an IP address enables a communication independent of subnetworks. For example, Ethernet, Token Ring, and FDDI (Fiber Distributed Data Interface) are network architectures of this type, in which the IP address enables a communication independent of subnetworks. For example, a device on an Ethernet network is identified based on its individualized network card-specific Ethernet address. There is no correspondence between this physical address and the IP address.

The address resolution protocol (ARP, Address Resolution protocol) finds out the correspondence between the IP address and the physical address. When a device of the network, e.g. a work station, wishes to find out the address of another device, it may find it out either from a name manager or local address boards. By the common network part one can judge that the devices are located on the same network. The work station sends an ARP request packet that includes, e.g. its Ethernet address. The ARP frame proceeds inside the Ethernet frame and not in the IP frame. A Proxy-ARP is a protocol to be defined on the router. In it, the router responses to queries by sending its own address, or the IP address of the desired partner. The transmitting component thinks that it has received

a fixed address and sends packets to the router, which, however, keeps forwarding them to the appropriate address.

Furthermore, the problem with the wireless Internet is the implementation of billing by transaction basis. Usually, a bit-based billing has not been applied very much in the existing IP networks. A transaction-based billing the party operating the route network has not been able to apply at all.

At his point there is a considerable difference between a bit-based and transaction-based billing. It is possible to implement the bit-based billing by means of a GGSN component (GGSN, Gateway GPRS Support Node) and a SGSN component (SGSN, Service GPRS Support Node). The aforementioned components are, however, not capable of implementing a transaction-based billing. This is due to the fact that the GGSN and SGSN are, from the point of view of the IP traffic, mainly only routers that do not take a stand on the user data of the packets.

The objective of the present invention is to eliminate the drawbacks referred to above. One specific objective of the invention is to enable the arranging of transaction and subscriber-specific billing on the wireless Internet. The method of the invention enables the collecting of subscriber-specific billing data from the existing standardized IP devices.

BRIEF DESCRIPTION OF THE INVENTION

The present invention is used for the arranging of billing in a telecommunication system in which billing data is collected by transaction and subscriber-specific basis from commercial IP devices. Examples of commercial IP devices are e.g. a WWW Proxy and WAP gateway (WAP-GW, WAP Gateway). The access network, service network, and telecommunication network are so configured that the mobile subscriber is able

to transfer information from the Internet network to the mobile station. The access network is a packet-switched telecommunication network, i.e. a GPRS network that has been so configured with the mobile communication network that the transfer of information packets from the Internet network to the mobile station is enabled. The service network is used to mean a network formed by the transmission components that comprises a WWW Proxy and a WAP gateway, as well as other routing components and databases. The components of the service network have been so arranged that they are able to collect, save, and forward subscriber and transaction-based billing data related to data transfers conducted at a particular interval. The telecommunication network is in this invention an Internet network.

In the method of the invention, subscribers are allocated an address from the internal address space of the access network, and the transmission component of the service network, the WWW Proxy, is allocated an address from the address space of the Internet network. The WWW Proxy enables one to create for the subscribers a so-called "virtual IP space", in which each subscriber has got their own static IP address. In the method of the invention, a connection is established between the subscriber and the Internet network by way of the transmission component, and billing data is collected from the transmission components conducting transactions, such as the WAP gateway and WWW Proxy, based on the identification information of the static IP address (the IMSI or MSISDN number). Billing data about the amount of data transferred is collected at a particular time interval. The subscriber-specific billing data records are sent further to the billing system, and they constitute a subscriber-specific total invoice. Important from the point of view of the invention is the attaching of the

subscriber number (IMSI, International Mobile Subscriber Identity) or the MSISDN (Mobile Subscriber Integrated Services Digital Network) to the IP address of the subscriber. By means of this, the transmission components are able to identify the subscriber for billing. The transmission component must also be capable of identifying the subscriber, and finding out whether the subscriber is entitled to the service selected.

10 In one embodiment of the invention, the transmission components of the service network are selected from a set which comprises a WWW Proxy and a WAP gateway (WAP-GW, WAP-Gateway).

15 In one embodiment of the invention, the subscriber-specific IMSI or MSISDN number is attached to the subscriber's address, and the IP address is converted into a MSISDN number in conjunction with the subscriber authentication. There has to be a subscriber-specific address in order that the routing could be done to the appropriate subscriber. The address conversion is mandatory in order that the authentication and the attribution of billing could be done to the appropriate subscriber.

25 In one embodiment of the invention, there is arranged on the service network a database to which there are saved the addresses of the subscribers and the individualizing identification information related to them. In the authentication, the information that is included in the database is compared to the subscriber address from which the query was made. In addition, in the invention there is saved to the database of the aforementioned transmission component a transaction and subscriber-specific log file related to the amount of data transferred at a particular interval, as well as the piece of information on what address the query was made from.

In one embodiment of the invention, the subscribers are allocated an address, for each transaction specifically, from a set of addresses, and by means of the aforementioned transmission component there is collected information on the amount of data transferred at a particular interval, as well as the piece of information on what subscriber-specific address the query was made from. The question is about this kind of dynamic allocation in such a case when only one component of the system collects information on what IP address is at the subscriber's disposal at a particular point of time, and the allocation always concerns an available IP address.

In addition, the invention relates to a system for implementing billing in a telecommunication system comprising a packet-switched telecommunication network, in which there are handled operations related to the transmission of a wireless data transfer, a terminal device, by which the subscriber is connected to the packet-switched telecommunication network, a service network, which comprises a set of transmission components, a telecommunication network, and a transmission component which is connected to the packet-switched telecommunication network as well as to the telecommunication network.

The system also comprises an address generator which is used to attach the information individualizing the subscriber, such as the IMSI or MSISDN number, to the IP address, for subscriber authentication and billing. In addition, the system comprises a registration device which is arranged in the transmission component or in its conjunction in order to register, for each transaction and subscriber specifically, the data transfers from a particular address at a particular time interval.

In one embodiment of the invention, there is arranged in the transmission component a generator

which is used to generate, based on the individualizing information, a subscriber-specific record of total invoices concerning registered data transfers. The system also comprises a transmitter which is used to
5 send the subscriber-specific records of total invoices to the billing system.

In one embodiment of the invention, there is arranged in the system a converter which is used to convert the IP number into a MSISDN number in conjunction with the subscriber authentication.
10

In one embodiment of the invention, there is arranged in the transmission component a transaction counter which is used to register, based on the individualizing information, the subscriber-specific data transfers at a particular interval, as well as a saving block which is used to save, based on the individualizing information, to a log file information on the amount of information transferred at a particular interval, and information on what subscriber-specific
15 address the query each time was made from.
20

In one embodiment of the invention, the transmission component comprises a saving block which is used to save, based on the individualizing information, to a log file information on the amount of information transferred at a particular interval, and information on what subscriber-specific address the query each time was made from.
25

In one embodiment of the invention, there is arranged in the system a database query entity which is used to collect records saved by the transmission components for generating a subscriber-specific record of total invoices and for sending it further to the billing system.
30

The advantages of the invention over prior art are that billing data may be collected for each transaction and subscriber specifically from commercial IP devices. Furthermore, when it is possible to
35

derive from the IP address the IMSI or MSISDN number, the correlating of a subscriber-specific billing and the building of total invoicing is more straightforward.

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BRIEF DESCRIPTION OF THE DRAWINGS

In the following section, the invention will be described in detail with reference to the accompanying drawing, in which

10

Fig. 1 represents one advantageous system in accordance with the invention, and

Fig. 2 represents one advantageous signaling diagram illustrating the function of the present invention.

15

DETAILED DESCRIPTION OF THE INVENTION

The system as shown in Fig. 1 comprises a packet-switched telecommunication network, i.e. a GPRS network, terminal devices MS, by which the subscribers are connected to the GPRS network. These form the access network as shown in Fig. 1. The system as shown in Fig. 1 also comprises a service network. The service network comprises the transmission components WAP-gateway WAP-GW and WWW Proxy as well as the data base query entity DQ. The transmission components are connected to one another and the data base query entity DQ is connected to the WAP gateway and to the WWW Proxy. In addition, the system as shown in Fig. 1 comprises an Internet network which is connected to the GPRS network by way of the WWW Proxy, as well as a WAP gateway for connecting the GPRS network and the WWW Proxy.

The WWW Proxy functions as a unit controlling the traffic that saves, for each subscriber specifically, billing data concerning the transactions, and based on this information, collects records for total

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invoicing. The WAP-GW is responsible for the transmission of the traffic consistent with the WAP protocol and collects billing data on the WAP transactions. The database query entity DQ as shown in Fig. 1 collects
5 billing data from the transmission components, WWW-GW and WWW Proxy, and sends the subscriber-specific records of total invoices further to the billing system.

The system as shown in Fig. 1 also comprises a pointer generator 1 which is used to attach the
10 piece of information identifying the subscriber, the IMSI or MSISDN number, to the IP address of the subscriber for subscriber authentication and billing. The system as shown in Fig. 1 also comprises a registration device 2 by which the transmission components of
15 the service network are able to register, for each subscriber specifically, data transfers from a particular address at a particular interval. Upon receiving the subscriber's dialing onto the WWW Proxy, a converter 5 is used to convert the subscriber's static
20 IP number into a MSISDN number. After this, the transmission component of the service network may start the collecting of the billing data on the subscriber's data transfer by means of a transaction counter 7, when it knows the subscriber, i.e. the MSISDN number
25 individualizing the subscriber. The transaction counter 7 is used to register the amount of bits transferred by the subscriber and the total time used for the data-transfer process, and the saving block 8 of the system is used to save this information to the database of the transmission component to serve as a
30 subscriber-specific log file 9.

In the system as shown in Fig.1, there is arranged on the WWW Proxy also a generator 3 which is used to generate a subscriber-specific record of total
35 invoices concerning the aforementioned data transfer. As regards the billing process, important is that the network component participating in transmitting the

information is able, based on the subscriber's address, to derive e.g. the MSISDN number which enables one to generate the subscriber-specific invoice. The transmitter 4 of the system as shown in Fig. 1 is used
5 to send the subscriber-specific records of total invoices collected by the database query entity DQ further to the billing system.

Fig. 2 represents one advantageous signaling diagram illustrating the function of the present invention. The subscriber is allocated an address from
10 the internal address space of the access network, process 21. In the allocation, by means of the WWW Proxy, there is generated for mobile subscribers a so-called "virtual address space", in which each subscriber has
15 got their own static IP address. This has to be done because on the wireless Internet, the address space of IP version 4 allocated to subscribers is too small, and it is impossible to allocate each subscriber an address of their own. The allocation may also be dynamic, when an available IP address is searched for
20 the subscribers from a bigger set of addresses.

Also the WWW Proxy is allocated an IP address from the address space of the Internet, process 22. An IMSI or MSISDN number is attached to the subscriber
25 address, process 23. After this, the subscriber's dialing is transmitted from the terminal device MS to the GPRS network, arrow 24. The dialing may be, e.g. a request for WWW communication. The subscriber's dialing is directed by way of the GPRS network to the WWW
30 Proxy, arrow 25. The subscriber is authenticated on the WWW Proxy, process 25. The purpose of the authentication is to find out whether the subscriber concerned is entitled to the service, and at the same time, there is saved to the database of the WWW Proxy
35 the subscriber's IP address, from which the query was made, i.e. a conversion is done from an IP address into a MSISDN number. In the conversion, the WWW Proxy

compares the subscriber's IP address with the information in its own database, and based on these identification records, identifies the subscriber. Based on the identification information, the WWW Proxy is able to send the data desired by the subscriber to the appropriate IP address, and the billing may be attributed, for each subscriber specifically, based on the IMSI or MSISDN number included in the IP address.

After this, the WWW Proxy checks whether it can find the data desired by the subscriber in the transmission component, and whether the data is valid, process 26. The data desired by the subscriber is e.g. a WWW page, the up-to-dateness of which shall be checked, and whether the page in question is possibly already there in the database of the WWW Proxy. In this process 26, the WWW Proxy starts up the time-based counter of the transaction. If the data desired by the subscriber is already there on the transmission server, then it is sent to the IP address registered by the WWW Proxy to the GPRS network to be transmitted further on, arrow 28. The GPRS network transmits the data to the terminal device MS of the appropriate subscriber, arrow 29. Billing data on the data transfer is collected in process 30. Billing data is collected based on the amount of information transferred and the time spent for the data transfer from all the components conducting transactions. If the piece of information in accordance with the subscriber's dialing cannot be found among the web sites saved by the WWW Proxy, or if the step of validity of the piece of information cannot be accepted, then the piece of information is retrieved from the Internet network, arrow 31. The retrieved information is saved as a WWW Proxy site for a certain period of time, process 32. Billing data is collected by transaction and subscriber-specific basis and saved to the database of the transmission component, process 33. The data retrieved for

the subscriber is sent further to the GPRS network, arrow 34, and from it further to the mobile station MS of the appropriate subscriber, arrow 35. The transmission components collect, by transaction and subscriber-specific basis, billing data into records of total invoices, process 36. The database query entity DQ is used to collect the subscriber-specific records of total invoices from the transmission components, process 37, and the aforementioned records are sent further to the billing system, process 38.

The invention is not restricted merely to the examples referred to above, instead many variations are possible within the scope of the inventive idea defined by the claims.

CLAIMS

1. A method for arranging billing in a telecommunication system, which system comprises the steps of:

5 allocating an address to the subscribers from the internal address space of the access network;

allocating an address to the transmission components of the service network from the address space of the telecommunication network;

10 establishing a connection between the subscriber and the telecommunication network by way of the transmission component; and

collecting billing data from the aforementioned components,

15 characterized in that the method further comprises the steps of:

attaching a piece of individualizing information to the aforementioned subscriber address for authentication and billing;

20 registering by means of the aforementioned transmission components, for each subscriber specifically, data transfers from a particular address at a particular interval;

generating, based on the aforementioned piece of individualizing information, a subscriber-specific record of total invoices concerning registered data transfers; and

25 sending the aforementioned subscriber-specific record of total invoices from the aforementioned transmission component to the billing system.

30 2. The method according to claim 1, characterized in that the transmission components of the aforementioned service network are chosen from a set which comprises a WWW Proxy and a WAP gateway (WAP-GW, WAP-Gateway).

3. The method according to claim 1 or 2, characterized in that in the method, a sub-

subscriber-specific IMSI or MSISDN number is attached to the aforementioned subscriber address.

4. The method according to claim 1, 2 or 3, characterized in that in the method, the IP
5 address is converted into a MSISDN number in conjunction with the authentication.

5. The method according to claim 1, 2, 3 or 4, characterized in that in the method there is arranged on the service network a database to
10 which there are saved the aforementioned addresses of the subscribers and the aforementioned individualizing identification information associated with them.

6. The method according to claim 1, 2, 3, 4
tai 5, characterized in that in the method,
15 to the database of the aforementioned transmission component there is saved the transaction-specific log file relating to the amount of data transferred at a particular interval, as well as the piece of information on what address the query was made from.

7. The method according to claim 1, 2, 3, 4,
20 5 or 6, characterized in that in the method, the subscribers are allocated an address, for each transaction specifically, from a set of addresses; and

25 by means of the aforementioned transmission component, information is collected on the amount of information transferred at a particular interval, as well as the piece of information on what subscriber-specific address the query was made from.

30 8. A system for arranging billing in a telecommunication system comprising:

a packet-switched telecommunication network, in which there are handled operations connected with the transmission of data transfer;

35 a terminal device (MS), by which the subscriber is connected to the aforementioned packet-switched telecommunication network;

a service network, which comprises a set of transmission components;

a telecommunication network;

5 a transmission component which is connected to the aforementioned packet-switched telecommunication network as well as to the aforementioned telecommunication network for connecting them;

characterized in that the system further comprises:

10 an address generator (1) for attaching the piece of individualizing information to the subscriber-specific address for billing and identifying the client;

15 a registration device (2) in the aforementioned transmission component that is arranged to register, for each subscriber specifically, data transfers from a particular address at a particular interval;

20 a generator (3) in the aforementioned transmission component that is used to generate, based on the aforementioned individualizing information, a subscriber-specific record of total invoices concerning registered data transfers; and

25 a transmitter (4) which is used to transmit the aforementioned subscriber-specific record of total invoices from the aforementioned transmission components to the billing system.

30 9. The system according to claim 8, characterized in that the system comprises a converter (5) which is used to convert, in conjunction with the authentication, the IP number into a MSISDN number based on the information included in the subscriber database (6).

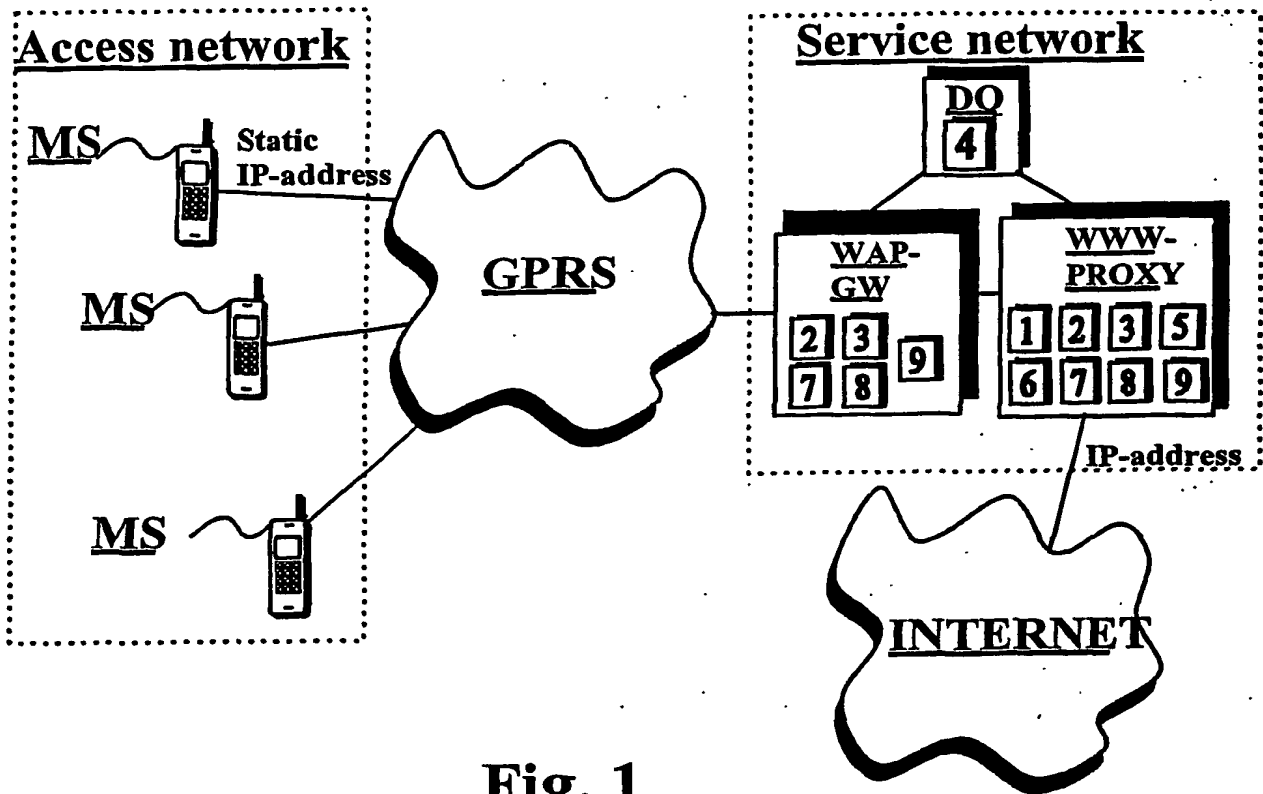
35 10. The system according to claim 8 or 9, characterized in that in the transmission component there is arranged a transaction counter (7) which is used to register, based on the individualiz-

ing information, subscriber-specific data transfers at a particular interval.

11. The system according to claim 8, 9 or 10, characterized in that the aforementioned transmission component comprises a saving block (8) which is used to save as a log file to the database (9), based on the information individualizing the subscriber, information on the amount of information transferred at a particular interval, as well as information on what subscriber-specific address the query each time was made from.

12. The system according to claim 8, 9, 10 or 11, characterized in that the system comprises a database query entity DQ which is used to collect records saved by the transmission components for generating a subscriber-specific record of total invoices.

1/2

**Fig. 1**

2/2

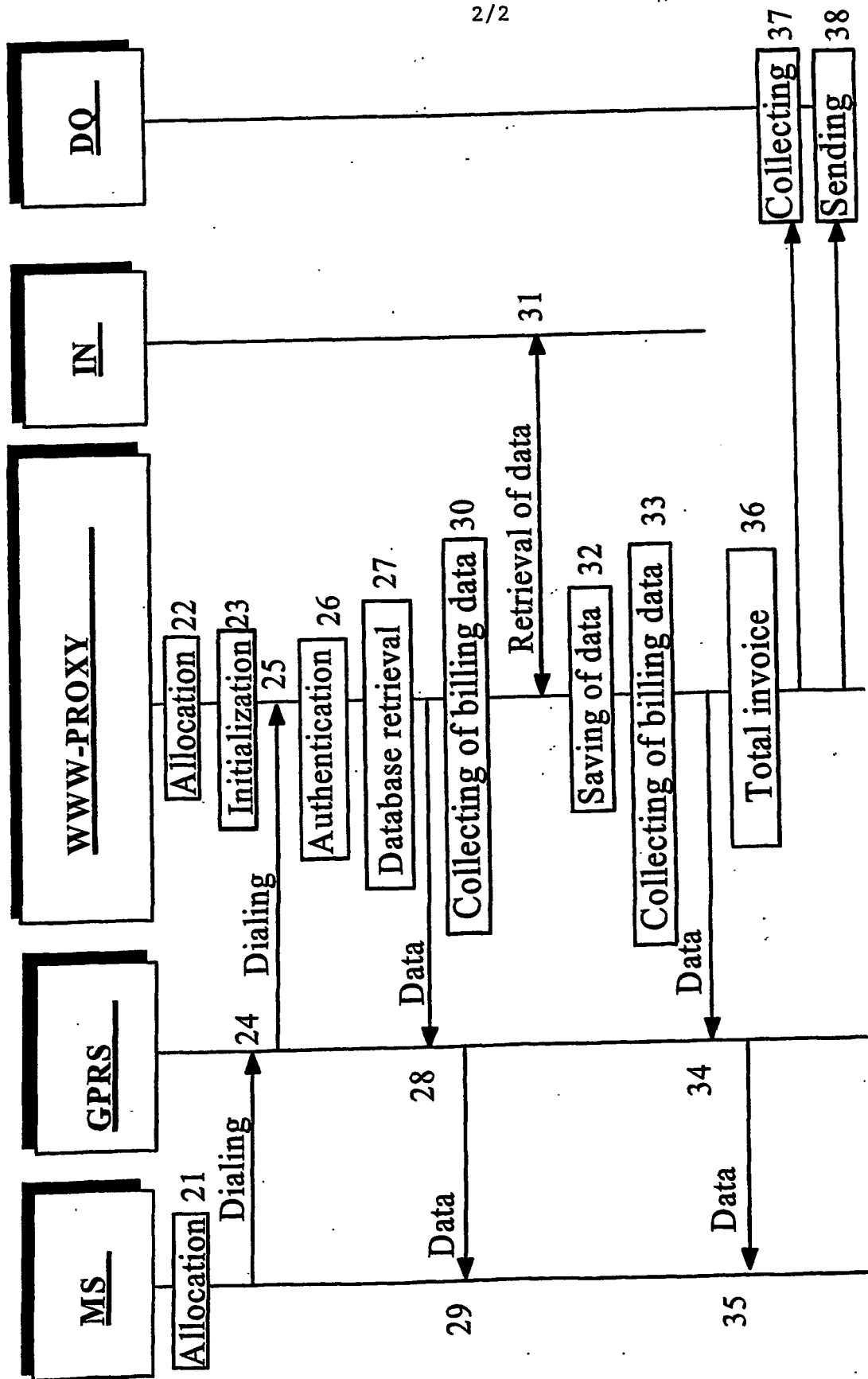


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/00786

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04L 12/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q, H04M, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim N .
X	EP 1014619 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 28 June 2000 (28.06.00), column 1, line 22 - line 39; column 2, line 2 - line 20; column 6, line 24 - line 29, col 6 line 45 - col 8 line 1, col 8 line 33-42	1,5-8,10-12
Y	--	2-4,9
Y	WO 0046963 A1 (APION TELECOMS LIMITED), 10 August 2000 (10.08.00), page 2, line 13 - line 15; page 5, line 7 - line 8; page 6, line 26 - line 28, page 19 line 13-22	2,4,9
Y	WO 9934590 A1 (NOKIA TELECOMMUNICATIONS OY), 8 July 1999 (08.07.99), page 11, line 19 - line 25	3

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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